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FATHERLESS TURKEYS—PAGE 6

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Turkey Research

ARS research has contributed to significant change in this Nation's turkey industry.

Current research will lead to more change and more profit for turkey raisers.

This month, many families throughout the U.S. will set their Thanksgiving tables with small, meaty turkeys—the result of ARS' development of the Beltsville Small White breed. The "Beltsville Turkey" has become one of the best-known products of the Agricultural Research Center at Beltsville, Md.

The turkey industry has benefited, also, from the National Turkey Improvement Plan, established by ARS in 1943. Through this program, the serious diseases pullorum and typhoid have been eradicated in the nearly 2,000 flocks, with 3.7 million birds, of 325 participating hatcheries. Scientists now have simple diagnostic tests for organisms causing two other diseases—parathyphoid and infectious sinusitis—and these tests will be used in participating flocks.

Market quality researchers, working to expand exports, recently shipped frozen turkeys 5,000 miles from North Carolina to Italy. Consumer use researchers have found that shorter cooking time makes for better roast turkeys.

Researchers have gained understanding of the phenomenon of parthogenesis—the development of embryos in unfertilized eggs—first discovered by ARS in turkeys in 1953. In itself, a parthenogenetic turkey is a curiosity—a weakling useless to a commercial breeder.

Significant to turkey producers, however, is the finding that parthenogenesis can occur in *fertilized* turkey eggs (page 6). Now, researchers ask: Is this phenomenon related to the fact that the average hatching rate in commercial turkey breeding flocks is only 60 percent of all eggs set? In chickens, by contrast, parthenogenesis is extremely rare and 80 percent of all fertilized eggs hatch.

Scientists hope to find the answer. They also hope to overcome the problem, increase hatching rates, and increase profits for turkey producers.

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Orville L. Freeman, Secretary
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W. H. Redit and W. L. Smith, Jr., ARS researchers at Beltsville, Md., dip peaches in hot water to test its effect in preventing decay.
(Photo No. PN–1420)

For Fruits and Vegetables . . .
HEAT TREATMENT PREVENTS DECAY

ARS SCIENTISTS are literally making it too hot for the comfort of decay organisms that sometimes destroy produce before a grower or packer can get it to his customers.

Hot water baths or hot air treatments killed decay organisms on 14 fruits, vegetables, and chestnuts without injuring the commodities in tests at 8 ARS marketing research field stations from Maine to California.

Hot water dips also protected Stayman apples and Anjou pears from scald, the unattractive skin mottling that sometimes develops during storage and marketing.

Cantaloups, peaches, mangos, and lemons are being heat-treated commercially, but for most of the other commodities, heat treatments are still

Peaches at left, used as control in heat treating experiment, show decay caused by brown rot. Dipping in hot water prevented decay in fruit at right. (Photo No. PN–1421)

HEAT TREATMENT PREVENTS DECAY (*Continued*)

experimental. Their advantages must be confirmed under packinghouse conditions before they can be recommended for commercial use.

Potential advantages are impressive—hot water or hot air treatments are cheaper, safer, and easier to use than chemical controls for decay.

Moreover, heat treatments prevent decay caused by organisms that get under the skin, beyond the reach of chemicals.

Under laboratory conditions, heat treatments had no adverse effect on the appearance, firmness, taste, and overall quality of the products tested.

As with any decay control, there are precautions and limitations to the use of heat treatments. Good sanitation in the packinghouse is more important than ever, because subsequent contamination of heat-treated products can offset benefits of the treatment.

Serious losses will also result if the water or air temperature is too low or high, or if the commodity is exposed to heat for too long or short a time. Heated air must be close to saturation with water vapor to be effective.

Test results are as follows:

APPLES—Good results were obtained with Stayman Winesap and fair to good results with Red Delicious apples that were dipped 1 minute in water at 130 degrees F., to control scald.

BLUEBERRIES—A 1- to 2-minute dip at 125 degrees protected the berries from heavy decay loss. Berries exposed to hot (110 degrees), moist air for 30 to 60 minutes also were protected from decay.

CANTALOUPS—Melons remained free of mold 12 days after loading in railcars after being treated commercially at a water temperature of 128 degrees for 1½ minutes.

CITRUS—Several kinds of decay were prevented when lemons were dipped for 2 to 4 minutes in water at temperatures of 115 to 120 degrees; and oranges for 5 minutes at 129 degrees. Grapefruit was pitted too severely for heat treatment to be profitable.

CRANBERRIES—Hot water dips reduced decay by about 50 percent. Dips at 125 degrees for 2½ minutes injured late-harvested fruit, but worked well for berries harvested at other times. For late-harvested cranberries, best results were obtained with 10-minute dips at 115 degrees.

PEACHES—Peach growers in the Southeast have obtained good commercial results with hot water dips at 120 to 129 degrees for 3 minutes. Hot moist air also produced good results at 129 degrees for 10 minutes.

RASPBERRIES and STRAWBERRIES—Hot air treatments at 109 degrees for 40 minutes protected berries from decay. Hot water dips for 1 minute at 125 degrees protected red raspberries, but scalded strawberries.

PEPPERS—Bacterial decay of bell peppers was reduced about 70 percent by hot water dips for 1½ minutes at 128 degrees or 2½ minutes at 123 degrees. In packinghouse tests, brush-waxer units were contaminated with decay organisms and nullified the benefits of the treatments, thus demonstrating the bad effects of poor sanitation.

SWEETPOTATOES—Both hot air (110 degrees for 24 hours) and hot water (120 degrees for 1 minute, or 115 degrees for 5 minutes) protected sweetpotatoes from decay.

Several varieties of precut and whole seed potatoes are being tested at Presque Isle, Maine, and East Grand Forks, Minn. Other field stations are testing hot water or air on chestnuts, figs, mangos, papayas, pears, and tangelos. Tests will be made with additional fruits and vegetables and with other varieties of those already tested.■

For Biological Control . . .

Caged Female Insects Used To Trap Males

Each cage inside the trap contains a female lesser peach tree borer. Male insects attracted by females are caught in sticky substance applied to the trap. (Photo No. PN–1422)

CAN AN INSECT population be suppressed solely by using an overwhelming number of caged female insects to attract native males to traps?

And can an insect invasion be *prevented* by this technique?

Answers to both questions are being sought by ARS entomologists M. L. Cleveland, T. T. Y. Wong, and R. E. Dolphin at Vincennes, Ind. Their research may provide an additional biological method of controlling insects without the need for pesticides.

The method under test at Vincennes has been termed the sterile male technique in reverse. The sterile male method, which was highly successful in eradicating screwworm flies from the South, involves release of overwhelming numbers of male insects made sterile by exposure to radioactive cobalt. The males mate with native females, which produce no offspring.

At Vincennes, virgin female insects inside traps are being introduced to overwhelm the attractiveness of the native female population. Hopefully, the sex attractant will draw enough of the males to their destruction in the traps to achieve satisfactory control.

The studies are underway in a young commercial peach orchard that has not been invaded by lesser peach tree borers. The control technique will prove promising if the isolated orchard is still free of borers 5 years from now.

If the technique succeeds with the lesser peach tree borer, it may hold promise for suppressing populations of other damaging insects.

The lesser peach tree borer invades trees through pruning scars, freeze-injury cracks, and abrasions caused by mowers and other machinery used in orchards. Such injuries become more numerous as an orchard matures.

Present insecticide sprays do not give adequate protection against the insect, which is becoming a major pest of peach trees in the Midwest. The borers are difficult to control once they become established.

The entomologists aim to provide a ratio of 30 caged females to each female borer in the natural population. Sixty traps, each baited with two virgin female lesser peach tree borers, have been placed in the 45-acre orchard.

Traps are kept baited during the period when borers emerge, from late April until October. Half of the borers are replaced on alternate days from a supply reared in the laboratory.

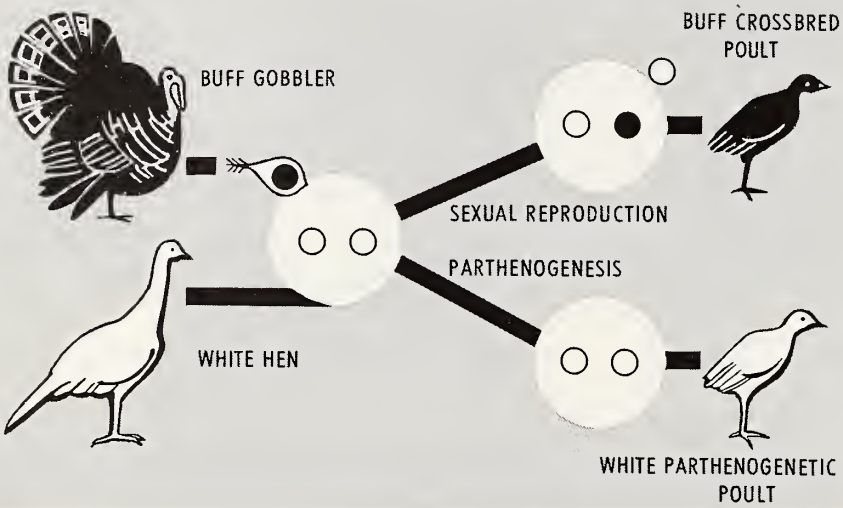
The flight range of the lesser peach tree borer has not been fully determined, although the entomologists have recovered males, marked with fluorescent dye, that were released 2 to 2½ miles from the traps. Up to 100 native males a day were being attracted to the traps in June.

The experiment is located more than 5 miles from the nearest commercial peach orchard, but about 750 peach trees are in home gardens within that radius. And, a number of native host trees other than peach have been found in the area.

Eventually, a synthesized sex attractant may replace the female borers in the traps. An extract of the attractant of the lesser peach tree borer has been recovered, and ARS chemists at Beltsville, Md., will attempt to identify it chemically and synthesize it.■

PARTHENOGENESIS IN TURKEYS . . .

Does It Influence Hatching Rate?



In normal sexual reproduction, chromosomes from buff male turkey and white female combine to produce buff offspring. If parthenogenesis occurs, chromosomes do not combine and white poult results. (Photo No. PN–1423)

Turkey eggs sometimes develop embryos even though they haven't been fertilized. Is this related to the fact that the average hatching rate for fertilized turkey eggs is lower than that for chicken eggs?

ARS poultry researchers aren't certain, but they're investigating this possibility.

About thirteen years ago, researchers found embryonic growth in eggs laid by turkey hens known to be virgins. When selectively bred for this trait, some hens produced unfertilized eggs that hatched, bringing to life the first parthenogenetic, or fatherless, turkeys. However, less than ½ of 1 percent of parthenogensis-prone turkey eggs hatch. The poults produced are all weaklings—useless to the commercial turkey breeder.

If Beltsville Small White Turkey hens are not inseminated, they produce normally one egg in five that develops at least some parthenogenetic cell growth after incubation. Hatching rate in mated turkeys is about 60 percent of all eggs set.

By contrast, if eggs from chickens that have not been inseminated are incubated, parthenogenetic growth is extremely rare. But with chickens, hatching rate for mated hens is 80 percent of all eggs set.

Could this mean that parthenogenesis can contribute to low fertility in commercial turkey flocks—by occurring in eggs from *mated* birds?

To try to answer this question, ARS poultry physiologist M. W. Olsen used descendants of the hens that first produced parthenogens. Nearly all unfertilized eggs laid by these birds develop embryos to some extent.

Olsen artificially inseminated hens from this research flock at Beltsville, Md., with weakened semen from New Jersey Buff males. Because the color buff dominates over white, Olsen could assume that all buff offspring would be true crossbreds. All white offspring would be parthenogens, uninfluenced by any hereditary characteristics other than those carried by the hen.

Of 124 incubated eggs, 26 developed embryos sufficiently mature to classify by color markings. Olsen found 23 buff embryos and 3 white ones. Thus, under experimental conditions, parthenogenesis occurred in eggs of mated turkeys. If commercial flocks are subject to parthenogenetic interference, Olsen explains, breeders would never notice it because there would be no color markings to judge by.

How could a mated hen have parthenogenetic offspring? At first, the egg is a one-celled ovum containing two sets of chromosomes, like all body cells in the mother hen.

The ovum normally ejects one set of its chromosomes shortly before it leaves the ovary and starts down the reproductive tract. A sperm, which also has one set of chromosomes, restores the full choromosome complement when it fertilizes the ovum.

In parthenogenesis, Olsen suggests, the ovum fails to eject one of its two original chromosome sets. When the sperm approaches such an ovum it may compete with the "unejected" set of chromosomes for a place in the ovum.

Assuming that this competition occurs, what are the odds for the sperm winning? As a partial answer, Olsen bred some parthenogenesis-prone hens with semen of full potency. About 60 percent of the eggs produced were fertile. But, of these fertile eggs, only one in four produced an embryo that hatched.

To what degree does parthenogenesis affect turkey fertility in commercial flocks? In continuing research, Olsen and other scientists hope to learn the answer.■

WHICH SILO FOR HAYLAGE?

How a farmer stores haylage depends on how much he needs it for feed and how much he wants to invest in safeguards to prevent spoilage.

Haylage—forage dried more than conventional silage but less than hay—appeals to farmers because of its high feeding value. It also has potentially lower storage losses than silage if handled properly.

In tests at Beltsville, Md., ARS dairy cattle nutritionist C. H. Gordon lost about 25 percent of the crop, on a dry-matter basis, when he stored forage straight from the field with about 82-percent moisture in a conventional concrete-stave upright silo.

By drying the forage to 70 percent moisture (conventional silage) and using good management procedures, he reduced losses to 8 to 12 percent. But by drying the forage to 60 percent moisture or less (haylage) and storing it in a gas-tight silo, he lost only 5 percent.

The superior potential of haylage, Gordon believes, is realized to the extent that air is kept out of the silo. Farmers have successfully stored haylage in gas-tight and conventional upright silos. Some have used bunker silos, which cost much less than concrete-stave upright silos but are harder to seal to keep air out.

Gordon compared haylage made in these three types of silos, and also tested conventional silage and haylage stored in stacks sealed with plastic.

He lost 21 percent of the conventional stacked silage, presumably because of small leaks in the plastic. The problem was worse with the drier haylage, since no known practical methods can bring about the continuous contact between cover and contents needed to prevent spoilage—a small puncture lets in air all around, and spoilage results.

Gordon found, however, that stacks 1 to 4 feet deep can be sloped enough so that the sides can be weighted. He believes haylage, if treated with a fungicide to retard molding, might be made successfully in such small, shallow stacks.

Of 11 fungicides Gordon tested, he found that one, called Mylone, retarded spoilage and did not reduce palatability of silage. While it shows promise, Gordon cautions that the trials with the fungicide were limited and therefore not conclusive.

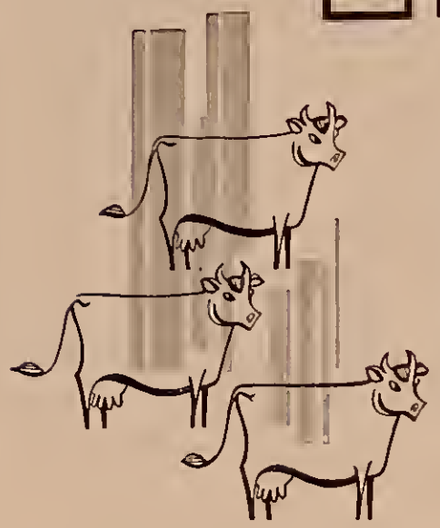
Bunkers cost less than standard concrete-stave silos, but are even harder to seal. Gordon has successfully sealed bunker silos with inexpensive plastic film, weighted on the top and sides with some of the chopped crop or sawdust to provide continuous contact between plastic and haylage. With this method, a small puncture does not expose the entire surface of the forage to air, and spoilage is retarded.

Successful sealing kept losses to only 9 percent in one test. But in another trial, when filling was delayed by rain and the plastic cover was severely damaged during storage, 28 percent of the haylage was lost.

A standard silo built of concrete staves is hard to seal but with proper sealing and management, Gordon averaged dry-matter losses of only 8 percent. He lost 24 percent of the stored feed from one silo, which was in poor condition.

With a gas-tight silo, dry-matter loss is generally less than 5 percent. But purchase price is high—about double that of a conventional silo in common family-farm sizes.■

VITAMIN E PREVENTS OFF-FLAVOR IN MILK



Members of taste-test panel rate flavor of milk from cows on green and dry feed. (Photo No. ST–1502–11)

Marianne Osborn[illegible]versity of Maryland graduate student, [illegible] odor of milk sample. [illegible] No. ST–1503–4)

Graduate student F. A. Burrows, Jr., checks taste of milk sample as part of flavor rating. (Photo No. ST–1503–11)

DAIRY FARMERS—especially those whose cows are on dry-lot feeding—should make sure their animals get enough vitamin E (tocopherol) in their diets to produce milk with a stable flavor.

Chemist R. L. King of the University of Maryland at College Park, working under an ARS grant, observed that dry forage contains very little of this vitamin compared with pasture grass and green forage.

This lack, King found, causes oxidized flavor—a cardboardlike, tallowy, or painty taste, depending on its intensity—that often makes milk unsuitable for sale.

The off-flavor develops very quickly when milk is brought into contact with copper. Since copper has long been known to have an adverse effect on the delicate flavor of milk, dairies normally take elaborate precautions to prevent contamination. But even the traces of copper naturally present in milk may be enough to give this objectionable off-flavor.

King experimented with a 22-cow herd on a basic ration of alfalfa hay and grain. He added various amounts of tocopherol acetate (a stable form of vitamin E) to the feeds every day for a few weeks, and then withdrew the supplement. In another trial, he took some of the cows off the dry ration and permitted them to pasture brome-grass or to feed on green-chopped alfalfa and pearl millet.

To determine the flavor stability of the milk produced under these conditions, he added to it one-tenth part per million of copper at the time of milking. Two days later he tested the milk for oxidized flavor chemically and with a taste panel.

Three or 4 days after he began supplementing the cows' diet with vitamin E, King found no oxidized flavor in the milk. Within 8 or 10 days after the supplement was discontinued, the flavor instability returned. Putting the cows out to pasture or on green-chopped forage had the same effect: The milk did not develop an oxidized flavor as long as the cows had access to fresh feed.

The amount of vitamin E fed to the cows (either by supplementing dry feed or by feeding green forage) and the amount later found in the milk were in direct ratio, King found.

His findings suggest that where milk may develop an oxidized flavor, dry rations should be supplemented with 1 or 2 grams of vitamin E per cow per day. This would cost about 8 cents per cow per day and in view of this additional cost, King feels that supplementation is justified only if flavor instability is a problem.

In the Maryland research, vitamin E was added to the ration at the time of feeding. It could be mixed with the feed beforehand, as at least one large feed manufacturer is now doing. This commercial experience should provide the basis for establishing the amounts required and the stability of the vitamin in the feed.

In future research, King hopes to find a means of overcoming the flavor instability of milk from cows on dry-lot feeding without supplementing their diets. One possibility is harvesting and processing feeds so that more vitamin E is preserved. In more basic research, King is studying the metabolism of the vitamin in cows and the level of copper that can be tolerated by a cow without making milk naturally susceptible to oxidized flavor development.■

R. L. King of University of Maryland Dairy Science Dept., tests chemically for flavor stability of milk sample. (Photo No. ST–1502–3)

ARS research chemist F. A. Blouin removes irradiated cotton from a chemical solution. Treated cotton will be tested for desirable new properties. (Photo No. PN–1425)

RADIATION, CHEMICALS IMPROVE COTTON FABRICS

ARS SCIENTISTS are treating cotton fabrics with chemicals and then with atomic radiation to create new textiles.

Experiments at the Southern utilization research laboratory in New Orleans have produced an extremely soft cotton that stretches almost 25 percent without breaking. Softness and stretchability are important to the appearance and durability of some clothing. Scientists have also developed cottons with thermoplastic properties (rigid at normal temperatures, plastic when heated) and improved resistance to abrasion.

They are now looking for ways to use this process to add other desirable properties—such as wash-wear, permanent-press, flame resistance, and oil and water repellency—to cotton.

Atomic radiation alone does not impart desirable characteristics to cotton. These result when the proper chemicals in the proper concentrations are combined with radiation.

Most materials are destroyed or badly damaged by atomic radiation. Doses big enough to take X-rays of the entire Nation's population break up the chains of molescules in cotton fibers, thus reducing fiber strength. Smaller doses (enough to make 40 or 50 million chest X-rays) do not damage cotton, but cause a loss of electrons, tiny electrically charged subatomic particles, leaving chemical structures known as free radicals.

Many chemicals can be grafted to the cotton wherever one of these free radicals exists, thus producing new textiles. The soft, stretchable cotton, for example, had been treated with acrylonitrile or styrene and then irradiated. Acrylonitrile, styrene, or vinyl acetate and radiation can produce the thermoplastic, abrasion resistant fabric.■

Durably pressed trouser cuffs of experimental fabric, right, withstood 22 accelerated laundry cycles without damage. Cuffs of conventionally treated fabric showed severe abrasion after 11 cycles. (Photo No. PN–1424)

TWO-TREATMENT PROCESS FOR ABRASION-RESISTANT COTTON

COTTON FABRIC given a permanent press in an experimental process with two chemical treatments instead of the conventional single treatment has shown up to twice as much resistance to abrasion as fabrics treated by the conventional method.

The new chemical treatment is one of several approaches ARS utilization scientists are taking to improve abrasion resistance in permanent-press fabrics. Another promising approach is blending treated and untreated fibers (AGR. RES., August 1966, p. 14).

The new process, costing only slightly more than conventional treatments, was developed by chemists W. A. Reeves, Carl Hamalainen, H. H. St. Mard, and A. S. Cooper, Jr., at the ARS Southern utilization re-

search laboratory in New Orleans.

The first step in the new process produces enhanced abrasion resistantance. The cotton fabric is wetted in a solution of wash-wear chemicals containing a special "orientation" catalyst, then dried and given a heat treatment called a "cure." The catalyst speeds up the reactions and is unchanged at the end of the process.

During the heat treatment, the orientation catalyst helps lock the chemicals inside the cotton fibers, but does not produce wash-wear characteristics.

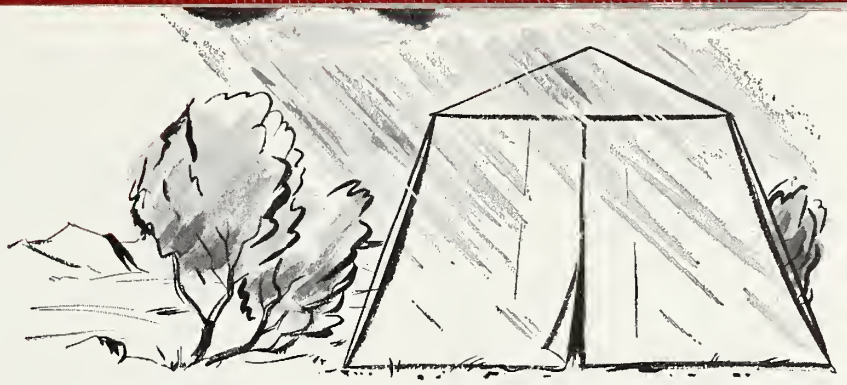
The second step is the usual wash-wear treatment. A conventional wash-wear catalyst is applied, and the fabric cured. The "cure" can be effected immediately following treatment, or it can be delayed until after the fabric has been made into garments and pressed to shape.

To test the abrasion resistance of these fabrics, samples were made into simulated trouser cuffs and subjected, along with control cuffs for comparison, to a series of laundering cycles in home-type automatic washers and tumble dryers.

Cuffs made from a cotton sateen treated by the experimental process withstood 22 accelerated laundry cycles before showing signs of abrasion. A hole appeared in the control fabric after only 11 cycles.

Another test fabric, a cotton twill, withstood 25 accelerated cycles without damage while the control fabric developed holes after 15 cycles.

The scientists don't know exactly why cotton treated by the new process has more abrasion resistance than cotton given the present type of treatment. They believe, however, that the treatment leaves the individual cotton fibers slightly swollen, allowing the separate parts of the fibers to move against each other more freely. When internal friction is thus decreased, abrasion resistance is increased.■



FOR WEATHER-RESISTANT COTTON

MINERAL DYES can now be applied to outdoor cotton fabrics in a simple, inexpensive process that imparts better weather resistance than methods now used commercially.

ARS chemists C. J. Conner, A. S. Cooper, Jr., and W. A. Reeves, and physical science technician G. S. Danna developed the new process at ARS' Southern utilization research laboratory in New Orleans.

Mineral dyeing, used since about 3,000 B.C., deposits inorganic pigments such as metals within the individual fibers of a fabric. Unlike other types of dyeing, there is no chemical bond between the fibers and the pigments.

In limited weathering tests, fabrics treated with the new process kept 90 percent of their original strength after 15 months' exposure on weathering racks. Some commercial fabrics retained only 40 percent of their strength after 1 year of exposure under identical conditions.

The new process, called the Zirchrome finish, requires no critical timing or temperature control and does not weaken the fabric. The fabric is wetted in the desired chemical solution, dried, and then cured to lock the chemicals in by heating the fabric to 320 degrees F. for 2 minutes or by letting it stand at room temperature for 24 hours.

Protective agents such as fungicides, mildew preventatives, and waterproofing waxes can be applied with the dye in a single bath. Textile equipment found in most textile finishing plants can be used.

In contrast, the process now used commercially to produce mineral-dyed fabrics requires up to four baths and other processing steps in equipment found only in a few large textile finishing plants.

In the conventional process, the fabric is wetted in the mineral dyeing solution, carefully dried, wetted in a caustic solution, carefully washed, dried, and then wetted again in a solution of any other protective agents desired. The first drying is critical. If the fabric is underdried, the mineral dye will wash out in the caustic solution; if overdried, the fabric is drastically weakened.

In the new process, the researchers used a water soluble form of chromium, along with zirconium ammonium carbonate and other chemicals in a single bath. On the fabric, the water soluble compounds were chemically converted to water insoluble zirconium and chromium oxides which effectively dyed the fabric pearl grey. Other colors could be imparted by using other minerals—iron for red and cobalt for blue, for example.■

WHICH GRASSES SURVIVE FLOODING?

BERMUDAGRASS, buffalograss, vine mesquite, and knotgrass survived flooding for more than 20 days—four times as long as some other range grass varieties—in recent ARS-Oklahoma tests.

These flood-tolerant varieties are suitable for planting in detention reservoirs, hundreds of which have been built on upstream tributaries of U.S. rivers in recent years. The reservoirs store excess runoff water during flood seasons; at other times, they are used for grazing livestock.

ARS agricultural engineer E. D. Rhoades built six impoundment basins that simulated field conditions. He established grasses in the basins and flooded them from 5 to 20 days at depths up to 6 feet. Tests were run in early spring, midspring, and late spring to correspond to normal flood seasons. The Soil Conservation Service and the Oklahoma Agricultural Experiment Station cooperated in the tests at the Southern Plains Watershed Research Center, Chickasha, Okla.

- Varieties that survived up to 20 days of flooding were Kanlow switchgrass, lowland switchgrass, Reed canarygrass, prairie cordgrass, and Florida paspalum.
- Varieties that survived up to 15 days of flooding were Caddo switchgrass, upland switchgrass, western wheatgrass, rice cutgrass, and smooth seed paspalum.
- Varieties that survived up to 10 days of flooding were big bluestem, sand bluestem, Virginia wildrye, and beaked panicum.
- Varieties that survived up to 5 days of flooding were eastern gamagrass, alkali sacaton, Elkan bluestem, KR bluestem, weeping lovegrass, Kentucky fescue, indiangrass, smooth brome, and knotroot bristlegrass.■

PESTICIDE FORM AFFECTS RUNOFF

THE CHEMICAL FORM in which a pesticide is applied to fields may greatly influence how much of it is washed off the soil during rainstorms, ARS scientists in Georgia have learned.

In their tests, agricultural engineer A. P. Barnett, agronomist E. W. Hauser, and soil scientist A. W. White found that as much as 27 percent of the herbicide 2,4-D in the ester form washed away, while only 3 percent of 2,4-D in the amine form was lost.

An amine forms a solution with water, the scientists explain, but an ester is relatively insoluble and forms an emulsion. The more soluble amine penetrates the soil. Because the ester remains nearer the surface, it is more susceptible to washoff.

Working in cooperation with the Georgia Agricultural Experiment Station at Watkinsville, the researchers applied artificial rain. They then trapped the soil-and-water mixture that ran off the slope of the field and tested the washoff for 2,4-D content.

Most 2,4-D loss occurred in the first 30 minutes of rainfall. Rainstorms of this duration occur frequently during the spring and summer in the Southeast.

The test plot soil, a sandy loam typical of 22 million acres of arable land in the southern Piedmont region, was fallowed before the tests and harrowed parallel to the slope to promote maximum washoff of chemicals.■

Controls of rainfall simulator are checked before 4-plot test to determine 2,4-D content in runoff, which is sampled from discharge pipes at lower left. (Photo No. PN–1426)

A technician services an automatic recorder used to check level of ground water 150 feet below. Data from the recorder proves little or no playa water enters the water table unless recharged wells are dug. (Photo No. PN–1427)

CHEMICALS CLEAN MUDDY WATER

INEXPENSIVE, easy-to-apply chemicals can clean muddy surface water so it can be put back into the water table, ARS scientists in Texas have learned.

Their use could save up to 85 percent of the water that now evaporates from high, undrained basins, agricultural engineer V. L. Hauser estimates.

These basins, called playas, are found in the Southern High Plains of New Mexico, Oklahoma, and Texas. Soils in the playa floors are virtually impermeable; consequently almost all the water that collects in playas is lost to evaporation.

For some time scientists have been experimenting with wells that will store this water underground for later use. Mud in the water has been a major obstacle; sediment quickly plugs up the wells. Filtering systems have been used, but are difficult to clean and operate.

In cooperative tests with the Texas Agricultural Experiment Station at Bushland, Hauser and ARS soil scientist F. B. Lotspeich found that adding a mixture of alum and cationic polyelectrolyte to the water reduced sediment content by 90 percent. Cationic polyelectrolytes are compounds that, because of their positive electrical charge, cause fine sediment particles to cluster and settle.

To test the chemical treatment under field conditions, the researchers drilled 6-inch wells near the edge of a playa. They drew water from the playa with a suction pump, treated it, held it for a time in a settling basin, put it through a coarse gravel filter to remove large debris, and finally released it into the wells.

About 20 million gallons of water were returned to the water table during the experiment. Eventually the wells began to clog, but they were easily restored to efficiency with a commercial well-bailing unit.

A mixture of 5 parts per million of alum and 0.5 per million of cationic polyelectrolyte proved to be the most economical and efficient water-cleaning treatment.■

WHEAT, SUDANGRASS FOR SPILLWAY PROTECTION

STOCKMEN CAN get speedy temporary erosion protection for newly constructed earth spillways by planting them to wheat or Sudangrass.

W. O. Ree, ARS hydraulic engineer, and W. W. Huffine, agronomist at Oklahoma State University, Stillwater, found in cooperative tests that these crops begin protecting soil from water erosion within a week after planting.

Perennial grasses are usually used to protect earth spillways. To be effective, however, the grasses must be planted in season (spring in Oklahoma). A spillway completed at some other time of the year would be unprotected until planting time.

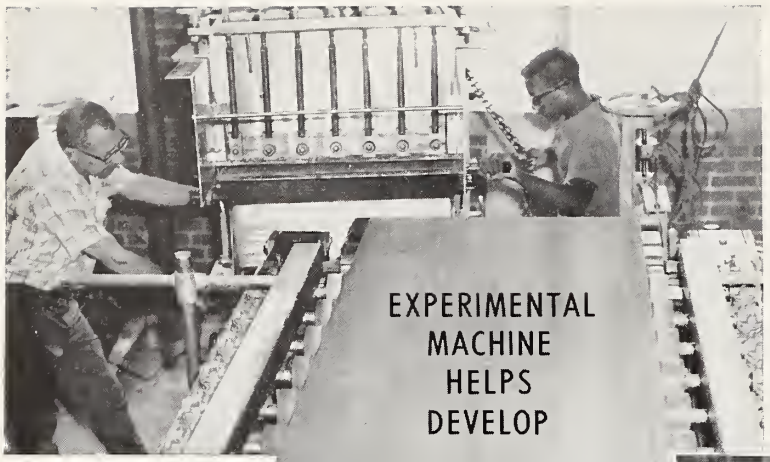
Unless a spillway is protected soon after completion, it may be scoured by rainstorms and may develop low spots that will lead to costly regrading or even destruction of the spillway.

The researchers planted wheat and Sudangrass in test channels filled with sandy loam soil and sloped 5 percent. Wheat was planted in the cool season, Sudangrass in the warm season; otherwise, treatments were the same for both.

Five days after the plant emerged, water was run over them for 40 minutes and the soil was checked for evidence of scouring. Flooding was repeated, with increasingly large volumes of water, until the soil scoured excessively. Plants 10, 20, and 40 days old were similarly tested.

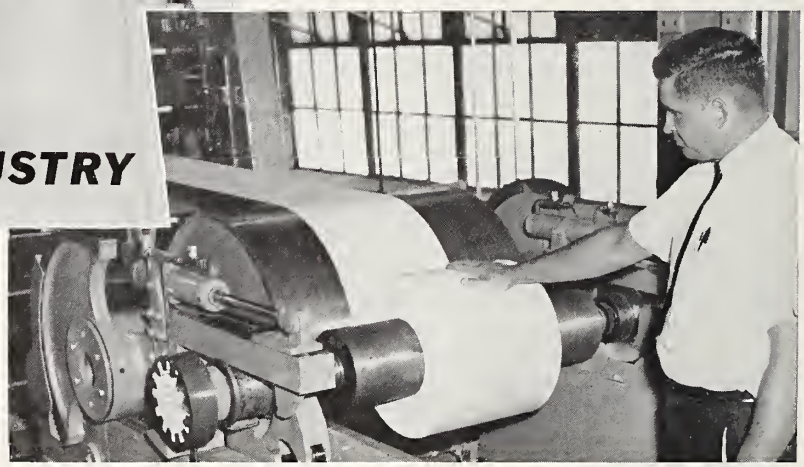
Height of the test plants—not density or planting pattern—made the most difference in erosion control. For example, plants 2½ inches high protected the test slopes from damage by a flow equivalent to 1 inch of runoff per hour from a 1,000-foot strip. Plants twice as high protected the slopes from 3 inches of water per hour.■

ARS technician J. C. Pierce measures the depth of water around 10-day-old Sudangrass with a point gage. Sudangrass can protect soil from water erosion within a week after planting. (Photo No. PN–1442)



Papermaker E. L. Curtis (left), and Charles Thomas, Jr., Youth Opportunity Campaign employee, maneuver a 29-inch headbox into position. Pulpwater suspension flows from headbox onto belt, is water-jet trimmed to 27 inches, and shrunk to dry paper about 26 inches wide. (Photo No. PN–1443)

Chemist G. E. Hamerstrand checks first bleached paper made on Northern laboratory machine. (Photo No. PN–1444)



EXPERIMENTAL MACHINE HELPS DEVELOP NEW PRODUCTS FOR PAPER INDUSTRY

A MACHINE large enough to make paper on a small industrial scale but precise and flexible enough for research will help ARS scientists find new ways to use starches, flour, and other cereal products in pulp and paper manufacture—already one of the largest nonfood outlets for cereal products.

The new research tool was designed especially for the Northern utilization research laboratory, Peoria, Ill., for studies to:

- Modify farm crops to make new products for use in the paper industry;
- Find the best ways to use these new products in paper and paper board;
- Show how the new products perform under industrial conditions, thus encouraging their acceptance by manufacturers.

The new paper machine eliminates many of the problems previously encountered in applying research results to industrial uses, ARS chemist B. T. Hofreiter points out.

Earlier laboratory machines produced sheets of paper 6 inches in diameter or strips 10 inches wide at speeds of 2 to 10 feet a minute. These were too small and too slow to provide adequate information about the performance of new products in industrial equipment.

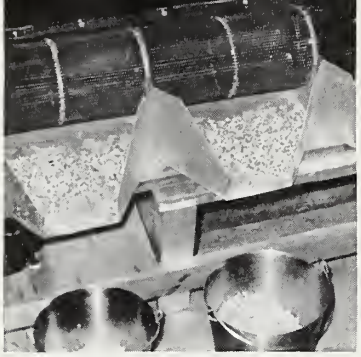
The new machine can make a wide variety of papers—from tissue to board—with trim widths of 12 or 24 inches at speeds of 50 to 500 feet a minute. In some operations, its speed equals that of commercial units.

The 12-inch paper will be made in exploratory studies. The 24-inch paper. closer to commercial widths, will be made in later studies and used to compare experimental and commercial paper and processes.

The machine can be set and operated precisely. Settings are recorded, and the operating conditions can be duplicated later. The two main parts of the new machine, the wet end and dryer sections, can be operated together or independently. Thus, paper improving chemicals can be added to pulp-water slurries or to the surface of the paper.

Starch, flour, and chemical derivatives and physical modifications of corn, wheat, and sorghum products can be used to impart many desired properties to paper. Cereal products can be added to pulp slurries to improve the wet and dry strength of paper; added to the paper surface as sizing or bonding agents; or applied as coating adhesives.■

FOR BETTER SOUTHERN PEAS



Rotary screen grader accurately separates southern peas by size.
(Photo No. PN–1445)

CANNERS AND freezers can now separate young southern peas from old ones for higher quality packs.

By combining two common separation techniques, sieving and brine flotation, ARS scientists at Weslaco, Tex., have developed a two-step separation process.

Southern peas are also called cowpeas, blackeye peas, or field peas in various parts of the country. This crop is grown as a fresh vegetable in fewer than a dozen southern States. About 60 million pounds of fresh, shelled southern peas are frozen or canned each year.

More and more fresh peas are being harvested mechanically each year, so field runs include peas at various stages of maturity.

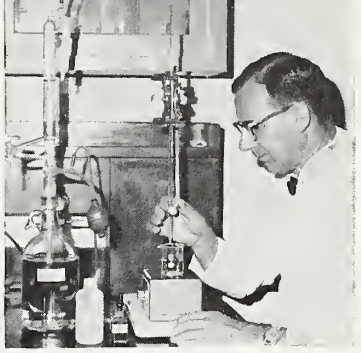
Unlike garden peas, which are size-graded and quality-separated before processing, southern peas are canned or frozen unseparated. But weeding out hard, overmature peas would give consumers a more nutritious and more uniform product and should help processors get more peas into the "Grade A: Fancy" category reserved for young, tender peas.

For the first step in their process, research chemists F. P. Griffiths and D. M. Tucker and technologist T. S. Stephens built a rotary screen grader that accurately sieves field-run peas—young, mature, and old—by size.

However, peas past their prime often shrink to the same size—and therefore sieve into the same container—as small but more nutritious immature peas. If frozen, the shriveled peas detract from the appearance of the product. When canned, the overmature peas swell, get mushy, and gel. The swelling makes it difficult to determine the proper headspace needed in cans when packing peas of varying maturity.

So, after sizing the peas, the researchers quality separated the smaller ones in a 3-percent brine solution. The immature peas floated; most overmature peas sank and were discarded.■

FOR CITRUS JUICE FLAVOR CONTROL



Chemist M. K. Veldhuis determines amount of peel oil in citrus juice.
(Photo No. PN–1446)

A QUICK AND accurate procedure to determine the amount of peel oil, which influences flavor in citrus juices, has been developed, assuring consistently high-quality products for consumers.

The technique, already used in many citrus processing plants for quality control and optional for USDA quality grading, was developed by ARS chemists W. C. Scott and M. K. Veldhuis, Winter Haven, Fla.

Peel oil—squeezed from the peels during juice extraction—plays an important role in juice flavor, and the amount going into juice must be closely controlled. Too much gives the juice a sharp, unpleasant taste and too little leaves the juice flat. Exact amounts must also be known for grading purposes.

The method previously accepted for USDA grading was accurate but slow, requiring about 90 minutes compared with about 7 minutes for the new method. At today's high speeds of production, citrus products could be packaged and in the warehouse before results were obtained by the earlier method.

Earlier rapid techniques were useful in controlling production but were inaccurate and unacceptable for USDA grading.

The new procedure is based on the fact that d-limonene, the principal component in citrus peel oil, combines with bromine to allow a simple chemical measurement of the amount of oil present.

In the process, oil is distilled from a small sample of juice, then acidified and colored with methyl orange indicator. To this is added, a drop at a time, a standard bromate solution. The bromate releases bromine which reacts with d-limonene. When all the d-limonene has combined with bromine, any excess bromine completely destroys the color of methyl orange. Multiplying the amount of bromate solution used by 0.004 gives the percentage of oil by volume.■

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AGRISEARCH NOTES

Pruning by Helicopter

The top branches of the tallest trees in a forest can be gathered for sampling rapidly and efficiently with a new helicopter-mounted tool developed by ARS and the Forest Service.

It is being used in a FS research project supported by the National Aeronautics and Space Administration. By collecting and analyzing tree-top foliage, scientists hope to develop new methods or types of aerial photography or imagery to determine insect and disease damage to forests.

The new tool, called a pole-pruner, was developed by FS research forester J. F. Wear and machinist Walter Wilson and helicopter pilot R. G. Winterfeld, both of ARS. The pruner can cut an 8- to 12-inch long branch tip and hold the cut branch until released by the operator.

Earlier methods used to collect tree-top samples—climbing the tree or shooting the top off with a rifle—were time consuming, difficult, and sometimes dangerous. With these methods, few samples could be obtained in a day.

The new unit is an 8-foot aluminum tube with a scissors-type cutting head on one end, a wire cable in the middle, and a carbon dioxide-powered two-way cylinder on the other end. A ⅜-inch sponge rubber tube permits the operator to slide the pole-pruner back along the helicopter fuselage and to grasp the branch and remove it from the cutter head. The pruner also has a safety line that prevents the tool from accidentally hitting the helicopter rotor blade. (Photo No. PN–1447) ■

Mosaic-Resistant Lettuce

Wild lettuce may provide germ plasm for breeding lettuce varieties with resistance to common mosaic, a cause of severe damage in many lettuce fields.

Working at Salinas, Calif., ARS geneticist E. J. Ryder evaluated hundreds of lettuce lines and varieties collected from all over the world and isolated two lines of a wild lettuce species resistant to the plant disease. The California Agricultural Experiment Station and the Growers-Shippers Vegetable Association of Central California cooperated in the research.

Plants of the two lines survived repeated virus inoculations, grew to normal size, and produced good sets of seed during 2 generations of testing. Ryder has crossed these resistant lines with 4 commercial lettuce varieties and is selecting plants from these crosses to determine the level and characteristics of their disease resistance.

Breeding resistant varieties is the most effective method of controlling common lettuce mosaic. Other control methods are less efficient because a large number of common weeds host the virus organism, and aphids transmit it from infected weeds to lettuce fields. Infected seeds also carry the disease. ■

CAUTION: In using pesticides discussed in this publication, follow directions and heed precautions on pesticide labels. Be particularly careful where there is danger to wildlife or possible contamination of water supplies.

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